A NEW TALINUM (PORTULACACEAE) FROM THE CEDAR GLADES OF MIDDLE TENNESSEE

STEWART WARE

Talinum calcaricum Ware, *sp. nov.* — *Herba* perennis, glabra, 7.0-20.0 cm. alta; *rhizoma* tuberosum. *Caulis* inferior succulentus, abrupte decrescens ad longum sine foliis stipitem filo metallico similem. *Folia* linearia, ad 4.5 cm. longa, teretia, aggregata. *Inflorescentia* vulgo systema tricotomum cymarum scorpioidearum, raro cyma singula terminalis scorpioidea. *Flores* ephemeri, post meridiem aperti; *sepala* 2, ovata, 3-4 mm. longa, 2-3 mm. lata, arescentia sed persistentia; *petala* 5, elliptica usque obovata, 8-10 mm. longa, 3-5 mm. lata, purpureo-rosea; *stamina* 25-45; *stylus* staminibus longior; *stigma* breviter trilobatum. *Capsula* pinguis, ovoidea usque obovoidea (raro ellipsoidalis), 4-6 mm. longa; *semina* matura 10-25 in capsula, 0.75 mm. lata, laevia, plumbea.

Glabrous herb perennating by a tuberous rhizome in soil surface; roots fibrous; stems one to several, lower succulent part to 8 cm. high, simple or branched, crowded with leaves, narrowing abruptly above to a leafless wiry stalk, to 15 cm. long. Leaves many, terete, fleshy, to 4.5 cm. long. Inflorescense a system of scorpioid cymes, usually with three primary branches, one or more of these sometimes secondarily branched, or occasionally a single terminal scorpioid cyme. Flowers regular, ephemeral, open from 1:00 p.m. to 6:00 p.m. CST (3:30 p.m. to 6:00 p.m. in Franklin Co., Alabama); sepals drying but persisting about fruit; petals 5, 8-10 mm. long; stamens 25-45; style longer than stamens; stigma with 3 short lobes, papillose; capsule ovoid to obovoid, 4-6 mm. long, unilocular, dehiscing by three valves; placentation free central: mature seeds 10-25, smooth, gray, dull, 0.75 mm. long. Shallow soil at the edges of rock exposures in calcareous cedar glades of middle Tennessee and northern Alabama. Flowers in May through September.

TYPE: TENNESSEE. DAVIDSON CO: southeast of Nashville on U.S. 70S, across road from Mt. View School; cedar glade; in shallow soil on limestone outcrop. Aug. 21, 1966. *Ware 215* (US). Isotypes at SMS, UT, VDB.

OTHER SPECIMENS EXAMINED:

TENNESSEE. DAVIDSON CO: 8 mi. SE of Una, at jct. of Old Hickory Blvd. and Charlton Lane, across from Burnette's Chapel, *Franklin, Freeman,* and *Sullivan 163* (VDB), *Quarterman 1653* (VDB), *Waits 059* (VDB), *Woodruff*, 16 July 1937 (UT); one mile N. of Burnette's Chapel on Laverge-Couchville Pike, *Franklin, Freeman,* and *Sullivan 229* (VDB); at type locality, *Ware 118* (VDB). Giles Co: S of Pulaski on limestone between Cedar Grove Church and quarry, *Ware 117* (UT, VDB). MARSHALL CO: one mi. E. of jct. of Tenn. 99 and U.S. 431 on Tenn. 99, along roadside and in bare places in cedar glade, *Franklin, Freeman,* and *Sullivan 147* (VDB). RUTHERFORD CO: N. of Murfreesboro, limestone barren opposite Stones River Mil. Park, *A. J.* and *Evelyn Sharp 25905* (UT); 5.3 mi. E of Murfreesboro, in rocky dry creekbed, *DeSelm 692* (UT); 1.9 m. NE of Rockvale on country road off Tenn. 99, occasional in openings, cedar glade near Snail Sheel Cave, *Franklin, Freeman,* and *Sullivan 316* (VDB); just N. of Murfreesboro, U.S. 70S, in roadside cedar glades, *Ware 119* (VDB). WILSON CO: S. of Gladesville, west end of Cedars of Lebanon State Park, glades along dirt road, *Ware 217* (VDB).

ALABAMA. FRANKLIN CO: E. of Russellville, cedar glade at jct. of Alabama 24 and Franklin Co. 79, *Ware 216* (UT, VDB).

Six terete-leaved species of *Talinum* have previously been reported in North America east of the Mississippi River. Two of these, *T. parviflorum* Nutt. and *T. calycinum* Engelm. are widespread west of the Mississippi but have been found east of the river only in southern Illinois (Jones, 1950; Mohlenbrock, 1955). A third species, *T. rugospermum* Holz., ranges from northwestern Indiana through Illinois, Wisconsin and northeastern Iowa to eastern Minnesota (Fernald, 1950; Gleason, 1952). The other three species are found only east of the Mississippi, and all occur in the southeastern United States. *Talinum appalachianum* Wolf is known only from two counties in central Alabama, growing on granite outcrops along either side of the Coosa River (David Cotter, 1966, personal communication). Wolf (1939) reported *T. mengesii* Wolf to be confined to Alabama, but McVaugh (1943) expanded its range to include the granite outcrops of Georgia, and specimens examined

in this study confirm its presence in Tennessee. The most widespread and best known of the eastern species of *Talinum* is *T. teretifolium* Pursh, which ranges from Pennsylvania serpentine barrens to the Altamaha grit of Georgia, but is best known from the granite outcrops of the Piedmont of the Carolinas and Georgia (Harper, 1926; McVaugh, 1943).

In the early stages of an ecological study of *Talinum* in the cedar glades of middle Tennessee, the question arose of the proper identity of these cedar glade plants. All floristic and ecological workers in the cedar glades, from Gattinger (1901) through Weiss (1959), identified the *Talinum* there as *T. teretifolium*, except Svenson (1941), who reported it to be *T. mengesii* on the basis of a specimen identified by Wolf. While the cedar glade plants key out to *T. teretifolium* in *Gray's Manual* (Fernald, 1950), they key out to *T. calycinum* in Gleason's (1952) *New Britton and Brown*, but do not fit his description of that species. They do not fall safely within the description of either *T. teretifolium* or *T. mengesii in* Small's (1933) Manual, though they are more like the latter species. The cedar glade plants also key down to *Talinum calycinum* in Wilson (1932) and Von Poellnitz (1933), but they do not fit the description of that species given by either of these two authors.

After herbarium specimens of cedar glade *Talinum* were examined and compared with specimens of *T. teretifolium*, *T. mengesii*, *T. rugospermum*, and *T. calycinum* from outside the Central Basin, it became apparent that the delicate flowers and fruits of this genus are so damaged by pressing and drying that critical specific characteristics may be lost, especially those relating to flower color and size, fruit shape and size, sepal persistence, and anther and style characteristics. Therefore, any meaningful study of the group would have to be based on living materials grown in the greenhouse, a situation first noted by Holzinger (1900).

Using the taxonomic works cited above, comparisons were made between the cedar glade *Talinum* and the characteristics of the six species of terete-leaved *Talinum* known to

grow east of the Mississippi. A dichotomous key was prepared for the seven entities involved, and this key was used to identify living material from various locations. From greenhouse and field observations, a table was prepared comparing the cedar glade plants with the two common southeastern species, *T. teretifolium* and *T. mengesii*

Talinum parviflorum and *T. appalachianum* have only 5 stamens, and can be eliminated from further consideration, for the cedar glade plants have many stamens per flower. Living material of five entities was studied: *T. teretifolium* (DeKalb Co., Georgia); *T. mengesii* (Marion and DeKalb Cos., Alabama); *T. rugospermum* (Tazewell Co., Illinois); *T. calycinum* (Saline Co., Arkansas); and cedar glade populations (Davidson, Rutherford, Marshall, and Giles Cos., Tennessee, and Franklin Co., Alabama). These population samples were grown in the greenhouse during the summers of 1965 and 1966, and compared with the sets of characters listed in the literature for each species, as well as with each other. Comparisons were also made with herbarium specimens from Vanderbilt University (VDB), the University of Tennessee (UT), and Southwest Missouri State College (SMS).

On the basis of living material and herbarium specimens, the cedar glade plants appeared to be more like *T. mengesii* than any other species, so careful comparisons were made of qualitative and quantitative characteristics which differed in the two groups of populations. These studies revealed that the cedar glade populations constituted a new species, *Talinum calcaricum*, named and described above.

Most of the differences between *T. calcaricum* and *T. mengesii* are quantitative, and many of them overlap in field populations, but the general aspect differences hold up in greenhouse plants grown from seed. The qualitative differences are remarkably constant, and these plus the non-overlapping quantitative ones make separation of individuals of the two species easy. A key to these and the other two southeastern terete-leaved species of *Talinum* is provided below.

Talinum calcaricum has fewer stamens, fewer seeds per capsule, darker colored petals, and is smaller throughout, except that it has considerably larger seeds than does *T. mengesii*. *Talinum calcaricum* has persistent sepals, a three-lobed stigma, an obovoid to ovoid capsule, and gray seeds, as compared with deciduous sepals, a subcapitate stigma, a subglobose capsule, and shiny black seeds in *T. mengesii*

TABLE I. A comparison of *T. calcaricum* with the two common southeastern Talinums.

	T. teretifolium	*T. calcaricum*	*T. mengesii*
Petal length	5-8 mm.	8-10 mm.	9-12 mm.
Petal color	pink	purplish-pink	pink
Style length	equal to stamens	longer than stamens	longer than stamens
Stigma type	three short lobes	three short lobes	sub-capitate
Stamen number	15-20	25-45	50-90
Sepals	deciduous	persistent	deciduous
Seed size (see text)	small	large	small
Seed color	shiny black	dull gray	shiny black
Substrate	Granite, serpentine, etc.	limestone	sandstone, granite

Quantitative data were gathered from three areas: a cedar glade just north of Murfreesboro, Rutherford Co., Tennessee, on U.S. 70S *(Ware 119)*; another cedar glade in

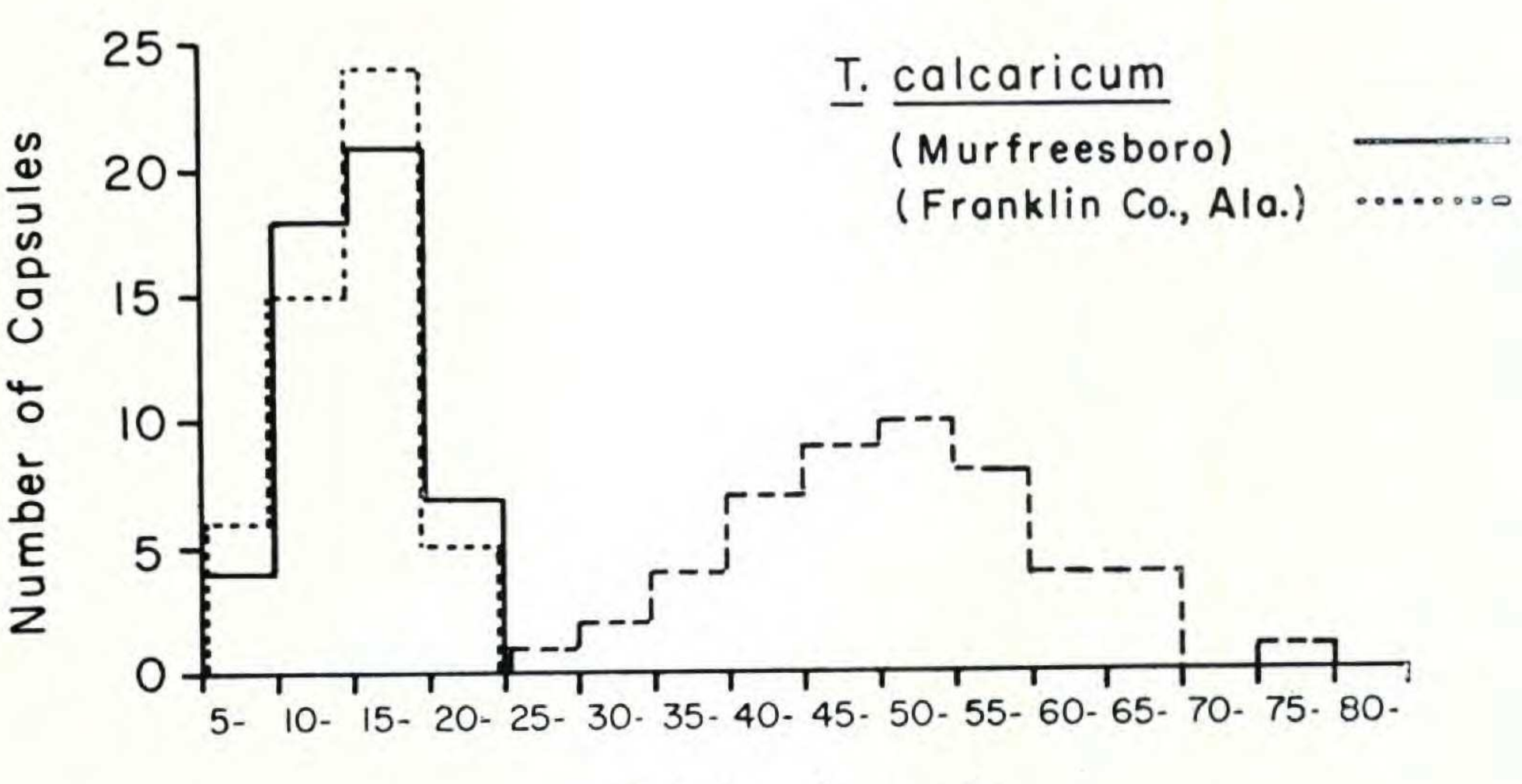

Fig. I. Comparison of two populations of *T. calcaricum* and a population of *T. mengesii* with respect to number of mature seeds per capsule.

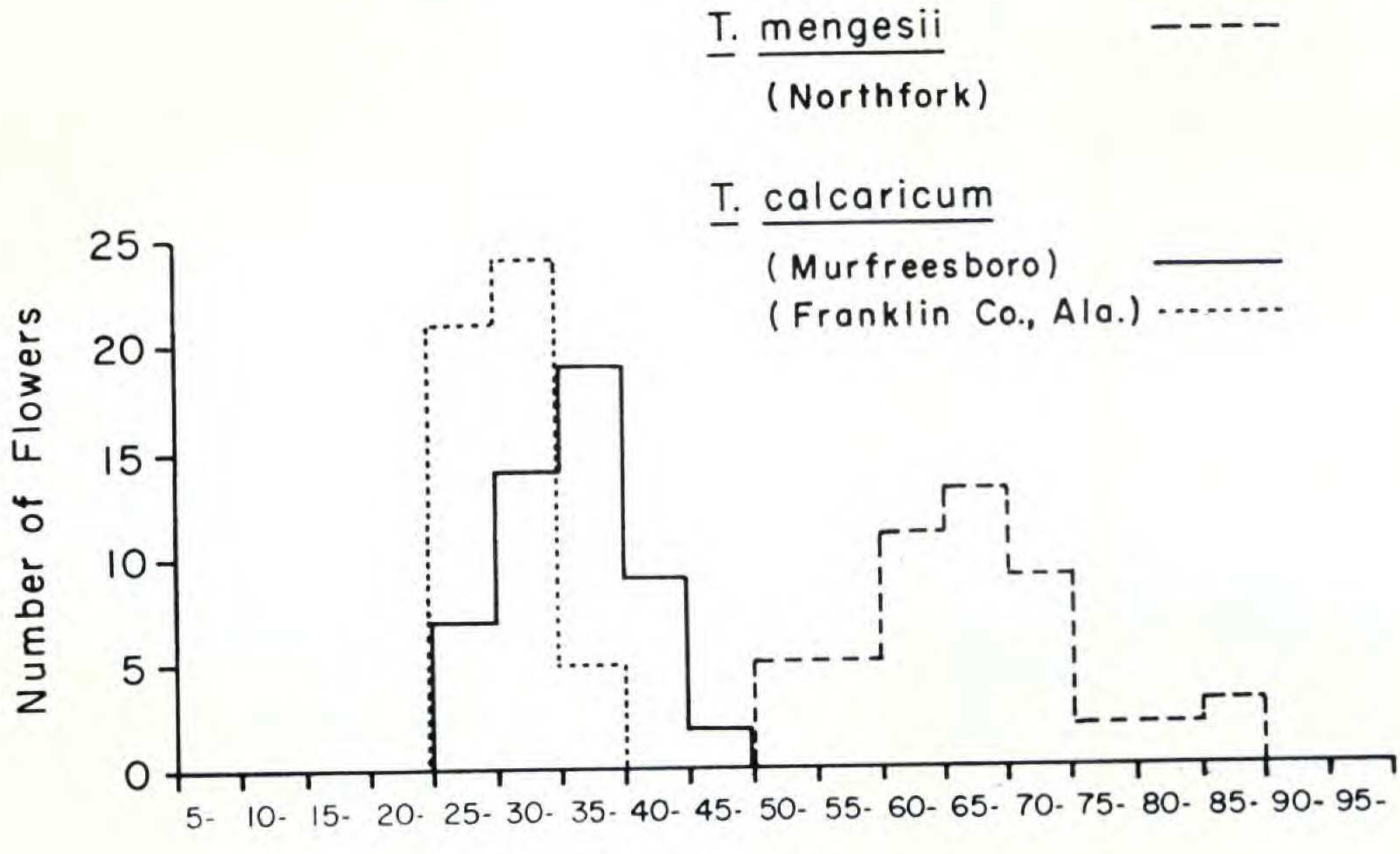

Fig. II. Comparison of two populations of *T. calcaricum* and a population of *T. mengesii* with respect to number of stamens per flower.

Franklin Co., Alabama, at the junction of Alabama 24 and Franklin Co. 79 *(Ware 216)*; and a population of *T. mengesii* from Marion Co., Alabama, on sandstone bluffs along Northfork Creek on U.S. 43 *(Ware 123)*. Fifty flowers and fifty capsules were collected from each population at one pace intervals along line transects across the population. At Northfork Creek and in Franklin Co., Alabama, flowers and capsules were preserved in 3:1 acetic alcohol and stamens and seeds were counted later; at Murfreesboro, counts were made in the field from fresh flowers and capsules. *Talinum calcaricum* consistently had fewer stamens and seeds per capsule than *T. mengesii* (Figs. 1 & 2), and there was no overlap in stamen or seed numbers between the two species.

To show a noticeable difference in size of seeds between *T. mengesii* and *T. calcaricum*, three replicates of 1500 seeds each were taken from the Northfork Creek *(T. mengesii)* and Murfreesboro *(T. calcaricum)* populations. The average weights per 1500 seeds were 264 mg. for *T. mengesii* and 628 mg. for *T. calcaricum*. Thus, the seeds of the cedar glade species are on the average more than twice as heavy as those of *T. mengesii*. This visible size difference and the gray *vs.* black color of the seeds are perhaps the best distinguishing characteristics on herbarium specimens.

CROSSING RELATIONSHIPS

Because the pistil is considerably longer than the stamens in both *T. mengesii* and *T. calcaricum*, capsules are not formed in the greenhouse unless pollination is manually effected; thus, emasculation of the flowers was unnecessary in crossing experiments. Reciprocal crosses between the five populations of *T. calcaricum* gave 95% to 100% of the seed yield considered to be "normal" on the basis of field sampling. Crosses between the two populations of *T. mengesii* likewise produced yields comparable to those noted in the field.

Crosses between *T. calcaricum* and *T. mengesii* gave quite different results. When Murfreesboro plants were pollinated with *T. mengesii* pollen, not one of 18 pollinations

yielded mature seed. When Franklin Co., Alabama *T. calcaricum* plants were pollinated with *T. mengesii* pollen, 4 of 9 pollinations yielded mature seed, but no capsule produced as many as the minimum of 9 seeds/capsule found in field studies of that population (Table II). In reciprocal crosses, with pollen from Murfreesboro *T. calcaricum* plants placed on *T. mengesii* styles, 17 of 20 pollinations yielded mature seed, but only one produced the minimum number of 25 seeds/capsule found in field studies of *T. mengesii*, and only three capsules produced more than ten seeds.

TABLE II. Results of crosses between *T. calcaricum* and two related species.

Pistillate parent	Staminate parent	Number of pollinations	Number setting seed	Number with normal yield
T. calcaricum (Murfreesboro)	× *T. mengesii* (Northfork)	18	0	0
T. calcaricum (Franklin Co.)	× *T. mengesii* (Northfork)	8	4	0
T. mengesii (Northfork)	× *T. calcaricum* (Murfreesboro)	20	17	1
T. calcaricum (Murfreesboro)	× *T. calycinum* (Arkansas)	9	4	0

After *T. mengesii*, *T. calycinum* is the species most like *T. calcaricum*. When Murfreesboro *T. calcaricum* plants were pollinated with pollen from Saline Co., Arkansas plants *(Demaree 53659)* which keyed out to *T. calycinum*, 5 of 8 pollinations produced mature seed, but no capsule produced the minimum number of 9 seeds/capsule expected for the Murfreesboro population.

This demonstration of barriers to genetic exchange (one of 55 crosses produced normal seed yield) between the cedar glade *Talinum* and the two species most like it, *T. mengesii* and *T. calycinum*, strengthens the idea that *T.*

calcaricum, recognized as a new species on morphological grounds, is a valid biological species.

FIELD KEY TO THE SOUTHEASTERN TERETE-LEAVED TALINUMS

A. Stamens 5 ..... *T. appalachianum.*
A. Stamens 15-many.
  B. Style not longer than the 15-20 stamens ..... *T. teretifolium.*
  B. Style noticeably longer than the 25-many stamens.
    C. Mature seeds black, shiny, more than 25 per capsule; stigma subcapitate; sepals deciduous; capsule subglobose; stamens 45-90 ..... *T. mengesii.*
    C. Mature seeds gray, dull, 10-25 per capsule; stigma with three short lobes; sepals persistent; capsule ovoid to obovoid; stamens 25-45 ..... *T. calcaricum.*

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